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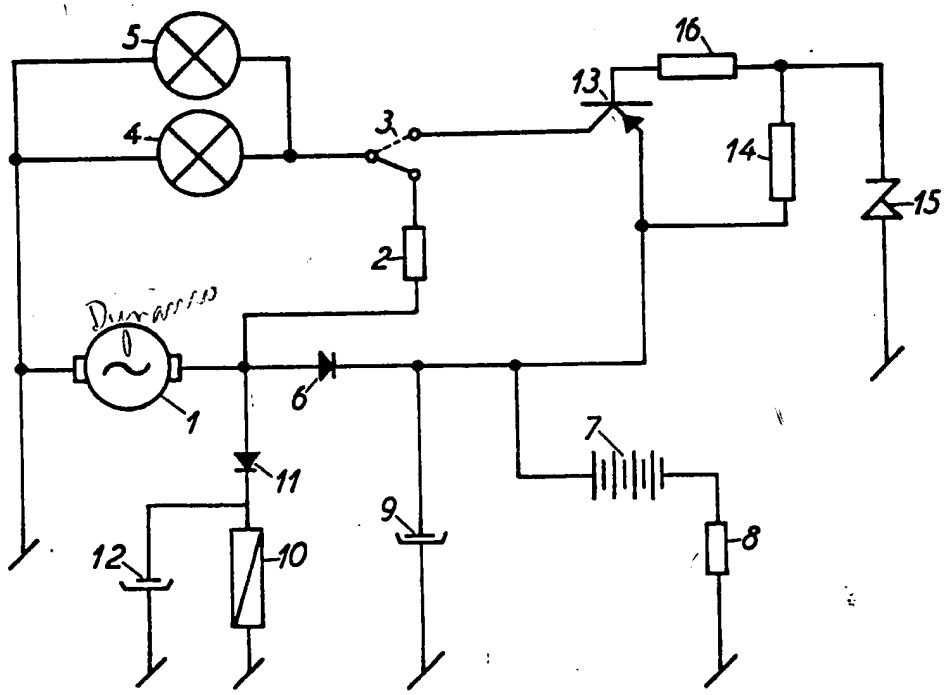

(57) Abstract

In a circuit for the discharge protection of a passive current source (7) a load (4, 5) is fed via the emitter collector circuit of a transistor (13), the basis of said transistor (13) being connected to a zener diode (15) via a resist r (16), the joint point of the resistor (16) and the zener diode (15) being connected to the current source (7) via a resistor (14). Thus a simple and effective cutting out of the load (4, 5) is achieved, when the voltage of the current source (7) falls below a threshold value determined by the zener diode (15).

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CIRCUIT FOR AUTOMATIC DISCHARGE PROTECTION OF A PASSIVE CURRENT SOURCE.

The invention relates to a circuit for automatic discharge protection of a passive current source, which is loaded by e.g. bicycle lamps.

When using dynamo lamps on a bicycle, the bicycle lamps can only emit light during bicycling, i.e. when the dynamo lamp is activated. When the bicycle is at a standstill, the lamps are off which means that the cyclist is running a great risk of being overlooked in the traffic. In order to solve this problem it is known to use a secondary current source in the form of a passive current source furnishing the lamps with

current when the cyclist is stopping. The change-over between these two power sources may take place electronically, for instance so that the secondary power source is cut in when the voltage of the dynamo falls below a certain level. This is known from e.g. the specification to DT-OS No. 2,443,415 describing a circuit for charging a battery and feeding a load in the form of bicycle lamps. The circuit consists of an emitter follower which by means of a zener diode functions as excess-voltage protection for battery and lamps. The circuit does not protect the battery which most advantageously is constituted by rechargeable Ni-Cd-cells, against a considerable discharging, shortening the lifetime of the cells considerably, reducing the efficiency and perhaps causing a change in polarizing.

From the specification to US Patent No. 3,648,145 a circuit is already known which causes a break in the connection between a power circuit and a load when the voltage of the current source falls below a predetermined threshold value. The electronic circuit performing this cutting out consists of a transistor circuit in the collector emitter circuit of which a relay coil is adapted to operate a switch for cutting out and cutting in the load. The base voltage of the transistor is provided by the current source via a voltage divider which thus loads the current source whether the load is cut in or cut out. This idle load is not very heavy, however, but enough as to make the device unfit for delivering the power supply to a bicycle, as a bicycle often remains unused for a very long period. Even a moderate discharging of the Ni-Cd-cells may thus cause damage to them.

It is the object of the present invention to provide a circuit for automatic discharge protection of a secondary current source of a bicycle, and which is not encumbered with the abovementioned disadvantages. This is achieved in that the current source feeds the load via the emitter collector circuit of a transistor, that the basis of this transistor is connected to a zener diode via a resistor, and that the joint point of the

resistor and the zener diode is connected to the current source via a resistor. This construction is simple and inexpensive to produce and secures the current source completely against discharging when the supply voltage falls below the threshold value determined by the zener diode. The circuit is thus especially suitable for being mounted on bicycles.

In the following the invention will be further described with reference to the drawing which shows a circuit according to the invention, which is coupled with a generally known circuit for charging a secondary passive current source.

On the drawing a dynamo 1 is shown, which is connected to two electrical bulbs 4 and 5, e.g. the front and rear lights of a bicycle, via a resistor 2 and a relay switch 3. The dynamo 1 is furthermore via a diode 6 connected to a number of Ni-Cd-cells 7, which are connected in series to a circuit breaker 8. A capacitor 9 is earthed parallel to the cells 7. A relay 10 is connected to the dynamo 1 in series with another diode 11, the relay 10 being connected in parallel to another capacitor 12. The Ni-Cd-cells 7 are connected to the electrical bulbs 4 and 5 via the emitter collector circuit of a transistor 13 and the switch 3, and loaded by a resistor 14 and a zener diode 15 connected in series. The basis of the transistor 13 is via a resistor 16 connected to the zener diode 15 and thus to the cells 7 via the resistor 14.

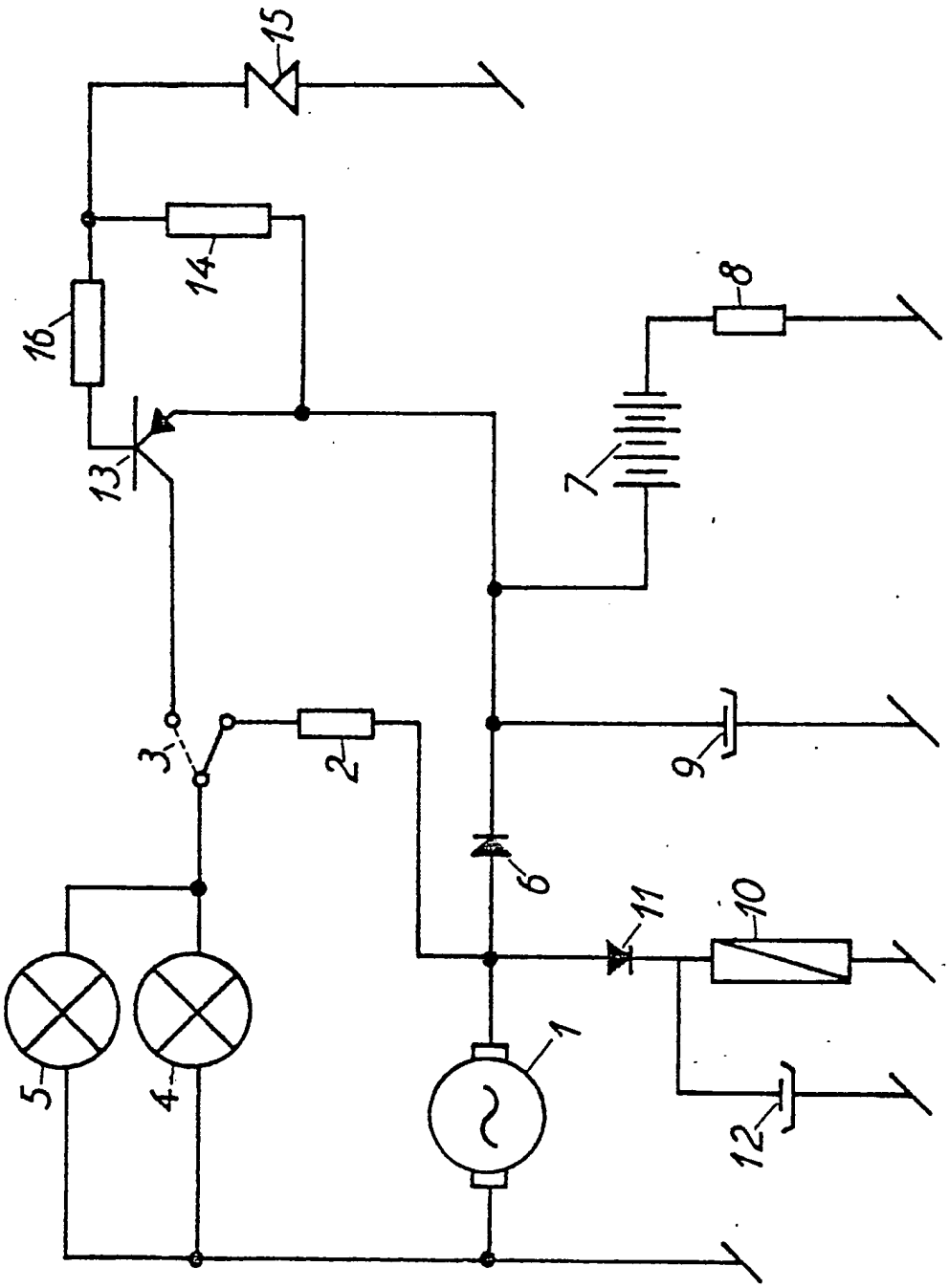
The circuit is functioning in the following manner. When the dynamo 1 does not produce power, the relay switch 3 is in a position of rest, shown with a dot-and-dash line, so that the electrical bulbs 4 and 5 under certain conditions, which will be explained later, are fed by the Ni-Cd-cells 7 via the emitter collector circuit of the transistor 13. When the dynamo 1 starts to produce power, the capacitor 12 is first charged through the diode 11, whereupon power starts to run through the relay 10, which draws the relay switch 3 to the position shown with the solid line. The electrical bulbs 4 and 5 are now fed by the dynamo 1, which simultaneously charges the Ni-Cd-cells, which are protected against a too

powerfull charging by the circuit breaker 8. When the dynamo 1 again stops producing power, or produces too little power, the relay switch 3 switches back to the position shown with the dot-and-dash line, whereby the Ni-Cd-cells 7 take over the feeding of the electrical bulbs 4 and 5. If the voltage of the Ni-Cd-cells 7 falls to a voltage below the puncture voltage of the zener diode 15, power cannot pass through the zener diode 15, which means that the emitter basis voltage drop of the transistor 13 is switched off. Thus the switch-off of the transistor 13 will follow the characteristic of the zener diode 15. The construction shown in the example can be used within a large voltage range by suitably dimensioning the components.

The invention is not limited to the use shown in the example, i.e. protection of the secondary current source of bicycle lamps, as the construction may be used in connection with all kinds of current sources.

C L A I M

Circuit for automatic discharge protection of a current source which is loaded by e.g. bicycle lamps, c h a r a c t e r i z e d i n that the current source (7) feeds the load (4, 5) via the emitter collector circuit of a transistor (13), that the basis of this transistor (13) via a resistor (16) is connected to a zener diode (15), and that the joint point of the resistor (16) and the zener diode (15) is connected to the current source via a resistor (14).



INTERNATIONAL SEARCH REPORT

International Application No PCT/DK80/00065

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

H 02 J 7/00, B 62 J 5/00

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	H 02 J 7/00, B 62 J 5/00
US Cl	320:13, 40

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US, A, 3 648 145 published 1972, March 7, The Singer Company	
A	DE, A1, 2 304 555 published 1974, August 1, Licentia Patent-Verwaltungs-GmbH	
A	DE, A1, 2 443 415 published 1976, March 25, Miebach Christian	
A	DE, A1, 2 507 780 published 1976, September 2, Marbach geb. Mensinger Johanna	

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"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [3]	Date of Mailing of this International Search Report [3]
1981-01-23	1981-02-02
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Swedish Patent Office	Sven Fenger-Krog Sven Fenger-Krog